

AMENDMENTS TO THE DRAWINGS

Attached are replacement drawing sheets 2-7, 9, and 15-17. These sheets, which include Figures 1B, 2-6, 8 and 14-16, replace the original sheets including Figures 1B, 2-6, 8 and 14-16. The replacement Figures do not alter the substance of the originals, but are redrawn for clarity.

Attachment: Replacement Sheets

INTERVIEW SUMMARY

Applicants thank the Examiner for the interview held on August 13, 2007. The Examiner's summary of the interview is correct, and will be only briefly reiterated here for the sake of formality. Those present for the interview included Examiner Kugel, applicant Andre Arsenault, and applicants' representatives Joan Van Zant, Christine Wong, and Phillip Pippenger. The discussion centered on the Galloro and Kulbaba references, and a number of distinctions between the art and the claimable subject matter were discussed, and Applicants committed to make certain amendments and clarifications.

*REMARKS***Drawings**

Figures 1B, 2, 3-6, 8, 14, 15, and 16 have been replaced with new Figures of better quality. No new matter has been added, and entry of these replacement Figures is respectfully requested.

Claims

Claims 1-29 and 52-88 are currently pending. Claims 30-51 were previously withdrawn. By way of this amendment, new claim 89 has been added. The amendments herein do not contain any new matter and do not raise new issues.

Indefiniteness - 35 USC § 112

Claims 28 and 86 stand rejected as being indefinite for a lack of antecedent basis for the phrase "the substrate." The noted deficiency has been addressed herein by amending the claims to introduce appropriate antecedent basis. In particular, the affected claims have been amended to state that "the cross-linked metallopolymer network is supported on a substrate."

Claims 56 and 82 were also amended to correct a similar issue. Specifically, claims 56 and 82 were amended to contain the additional phrase "the first constituents are formed on a substrate."

Claim 29 was rejected as being indefinite for including a term in parentheses. By way of this amendment, the noted term has been removed.

New claim 89 recites "aluminium or chemically treated gold," which were formerly recited in claim 82.

Novelty and Obviousness - 35 § USC 102 and/or 35 USC § 103

Claim 1 has been amended to state that the metal atoms are "switchable between more than one electronic configuration, by which uptake or expulsion of at least one of a selected fluid and an ion by the cross-linked metallopolymer network occurs" and that "expansion and

contraction of the cross-linked metallopolymer network [is] fully reversible." No new subject matter is introduced by way of this amendment. The claim further states that the cross-linked metallopolymer network is "expandable and contractible in response to the uptake and expulsion" of the selected fluid or ion, and that it is this expansion and contraction that shifts the Bragg diffraction wavelength.

Thus, claim 1 now clarifies that the metallopolymer network reversibly expands and contracts in response to controlled switching of the electronic configuration of metal atoms in the metallopolymer, and that this expansion and contraction results in shifting of the Bragg diffraction wavelength. By "fully reversible" is meant that the material is capable of being brought back substantially to its original dimensions after an expansion or contraction, as evidenced by the return of the Bragg diffraction wavelength back substantially to its original position (see page 43 of the application, with reference to Figure 9c).

The Action states that claims 1-27, 29, 52-83 and 86-88 are already disclosed in Galloro et al., *Replicating the Structure of a Crosslinked Polyferrocenylsilane Inverse Opal in the Form of a Magnetic Ceramic*, *Advanced Functional Materials*, May 2002, 12, No. 5, pp 382-388. Specifically, the Action states that Galloro teaches a tunable photonic bandgap material comprising self-assembled monodisperse microspheres of polystyrene, polystyrene-iron composites or silica - including silica that has been sintered to provide slight points of contact between the spheres - with diameters of 480 ± 11 nm having a face centered cubic lattice in a matrix of crosslinked polyferrocenylsilanes - including spirocyclic 1-silaferrocenophanes - wherein the microspheres and the polyferrocenylsilanes have different refractive indexes and exhibit Bragg's Law diffraction. The Action states that Galloro further teaches that the silica particles may be etched away with an aqueous HF solution to leave behind voids; such voids would be filled, presumably with nitrogen during pyrolysis.

Galloro teaches that a photonic material can be synthesized using crosslinked polyferrocenylsilane (CPFS), as discussed at the bottom of page 382, right column, to the top of page 383, left column. Galloro teaches in that same passage that the network is "highly crosslinked." Attached is an article by MacLachlan et al., which describes the material used by

Galloro. CPFS is shown on page 8562, left column, as compound 4. In the paragraph bridging pages 8562 and 8563, MacLachlan describes the highly crosslinked material as being immobile, insoluble and that it did not swell in solution. Such a material would not be able to expand and contract.

The procedure taught in Galloro also includes a high-temperature treatment of the silica spheres prior to introduction of the CPFS. This heat treatment permanently fuses the contacting points of the spheres together, making them unable to move relative to each other and hence making expansion or contraction of the material impossible.

The high degree of crosslinking taught by Galloro is necessary because Galloro is aiming to produce magnetic ceramics upon high-temperature pyrolysis (see page 383, left column, left paragraph). This results in an extremely tight-knit network, which is glassy and brittle, and cannot be swollen by any type of fluid. Thus, Galloro teaches a material that is not expandable or contractible and cannot take up or expel fluid, contrary to claim 1.

Galloro mentions tuning of the material, but this is done by magnetic means (see page 382, right column, paragraph 2), not by switching the electronic configuration of metal atoms in the material. It should also be noted that although the Action alleges that Galloro uses polymer spheres to form the material, this is not mentioned anywhere in that article. In fact, the conditions for the infiltration of the monomer material for the inverted structure (see page 383, left column paragraph 3) would have dissolved polymer spheres, rendering them useless.

Galloro fails to teach a cross-linked metallopolymer network material that is expandable and contractible in response to controlled switching of the electronic configuration of metal atoms in the material, as claimed in claim 1. Hence, claim 1 and the remaining claims, which are all dependent on claim 1, are novel over Galloro.

The Action alleges that claims 1-26, 29, 52-82, and 88 are unpatentable over International Patent Application Publication No. WO 01/18283 (Amos) in view of Kulbaba et al., *Organometallic Gels: Characterization and Electrochemical Studies of Swellable, Thermally Crosslinked Poly(ferrocenylsilane)s*, Macromolecular Chemistry and Physics, June 2001, 202,

No. 9, pp1768-1776. Specifically, the Action alleges that at the time of the invention, it would have been obvious to a person of ordinary skill in the art to include the crosslinked swellable poly(ferrocenylsilane)s including dimethyl spirocyclic-1-ferrocenophane taught by Kulbaba as the matrix polymer in the colloidal photonic crystals of Amos. The Action alleges that the motivation to do so would have been that the polymer network of Kulbaba can absorb large amounts of solvent without dissolving and may undergo rapid continuous or discrete volume changes in response to variations in its environment.

The Action alleges that claims 1, 28, 86, and 87 are unpatentable over U.S. Patent Application Publication No. 2002/0062782 (Norris) in view of Kulbaba. Specifically, the Action alleges that at the time of the invention, it would have been obvious to a person of ordinary skill in the art to include the crosslinked swellable poly(ferrocenylsilane)s including dimethyl spirocyclic-1-ferrocenophane taught by Kulbaba as the matrix polymer in the colloidal photonic crystals of Norris. The Action alleges that the motivation to do so would have been that the polymer network of Kulbaba can absorb large amounts of solvent without dissolving and may undergo rapid continuous or discrete volume changes in response to variations in its environment.

The Action alleges that claims 84 and 85 are unpatentable over Amos in view of Kulbaba in further view of U.S. Patent No. 4,351,929 (Nelson) or U.S. Patent No. 4,919,865 (Gibbs). Specifically, the Action alleges that at the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the toluene or acetone solvents of Nelson or the tetrahydrofuran or toluene solvents of Gibbs to dissolve the polymethylmethacrylate particles of the composition of Amos and Kulbaba since it has been held that it is *prima facie* obviousness to use a known material based on its suitability of its intended use.

All of the Action's allegations of obviousness rely on Kulbaba to teach a material that is suitable for expansion and contraction due to fluid uptake and expulsion in response to variations in its environment. However, claim 1 describes a material that expands and contracts in response to controlled changes in its electronic configuration, and such expansion and contraction are fully reversible.

Kulbaba discloses a crosslinked poly(ferrocenylsilane) material and tests the swelling of this material using different solvents. However, Kulbaba does not teach controlled switching of the electronic configuration of metal atoms in the material to effect swelling of the material. Rather, the redox tests carried out by Kulbaba affect the spectrum of the material by changing the oxidation state of iron atoms in the material to cause a color change, without any expansion or contraction of the material. There is no teaching of any swelling associated with the redox tests (see page 1774). Although there is a brief mention of swelling response to electrochemical oxidation at the bottom of page 1774, right column, this is purely speculative and would not constitute teaching or motivation to a person skilled in the art, particularly in view of the fragile nature of the material, which is discussed below.

On page 1771, right column, middle paragraph, Kulbaba states that "simple manipulation of the gel...resulted in mechanical degradation of the polymer network." Kulbaba further states on page 1774, right column, paragraph 2, that when carrying out redox tests on the material, "the spectrum obtained upon reduction of the oxidized gel had fairly poor baseline overlap with the spectrum of the reduced gel prior to oxidation." These passages indicate that the material disclosed by Kulbaba is unstable and flimsy. Such a material does not allow for fully reversible expansion and contraction because it breaks down after even one such expansion or contraction.

Hence, a person skilled in the art would not be able to turn to Kulbaba for a crosslinked metallopolymer network material that expands and contracts in response to controlled switching of the electronic configuration of the metal atoms in the material. In any event, even if the material was used for this purpose, despite a lack of any teaching by Kulbaba, the material is unstable and would not provide fully reversible expansion and contraction.

Kulbaba fails to teach a cross-linked metallopolymer network material that expands and contracts in response to controlled changes in the electronic configuration of the metal atoms in the material. Kulbaba further fails to teach that such expansion and contraction are fully reversible. Because Kulbaba fails to teach these features of claim 1, Kulbaba cannot be relied on to arrive at a finding of obviousness for the claim. None of Amos, Norris, Nelson and Gibbs

teaches any of these features. Hence, claim 1 and the remaining claims, which are all dependent on claim 1, are not obvious in view of these cited references.

Conclusion

Applicants respectfully submit that the present application is now in condition for allowance. If, in the opinion of the Examiner, a further telephone conference would expedite the prosecution of the subject application, the Examiner is invited to call the undersigned attorney.

Respectfully submitted,

By: 

Phillip M. Pippenger, Reg. No. 46,055
LEYDIG, VOIT & MAYER, LTD.
Two Prudential Plaza, Suite 4900
180 North Stetson Avenue
Chicago, Illinois 60601-6731
(312) 616-5600 (telephone)
(312) 616-5700 (facsimile)

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